2-4 Properties of Logarithms

Any positive number can be written as a power of 10. For instance,

$$3 = 10^{0.4771\ldots}$$

$$5 = 10^{0.6989\ldots}$$

$$15 = 10^{1.1760\ldots}$$

The exponents 0.4771…, 0.6989…, and 1.1760… are called the base-10 **logarithms** of 3, 5, and 15, respectively.

$$\log 3 = 0.4771\ldots$$

$$\log 5 = 0.6989\ldots$$

$$\log 15 = 1.1760\ldots$$

Objective Learn the properties of base-10 logarithms.

In this exploration you will learn about properties of logarithms. Logarithms give you an algebraic way to solve exponential equations such as $1.06^x = 2$.

EXPLORATION 2-4: Introduction to Logarithms

1. The LOG key on your calculator finds the logarithm of a given number. Evaluate these logarithms:

$\log 10 =$ __?__

$\log 100 =$ __?__

$\log 1000 =$ __?__

$\log 10000 =$ __?__

$\log 10^5 =$ __?__

2. From your answers in Problem 1, figure out what $\log x$ means. Write what you discover.

3. Based on your answer to Problem 2, what should $\log 10^{1.8}$ equal?

4. Test your conjecture in Problem 3 by finding the value of $10^{1.8}$ on your calculator and then finding the logarithm of the (unrounded) answer.

5. Test your conjecture again by finding $\log 347$ and then raising 10 to the power of the answer you get.

6. Find $\log 2$ and $\log 32$. Show numerically that $\log 32$ is *five times* $\log 2$.

7. Note that $32 = 2^5$. Thus, $\log 2^5 = 5 \log 2$. Show numerically that $\log 17^{2.34} = 2.34 \log 17$.

8. Complete the property of the *log of a power:* $\log b^x =$ __?__

9. What did you learn as a result of doing this exploration that you did not know before?